United States
Department of
Agriculture

Cooperative State
Research Service

February 1985

Animal Health Science Research Advisory Board

1984 Annual Report

ANIMAL HEALTH SCIENCE RESEARCH ADVISORY BOARD

1984 ANNUAL REPORT

Cooperative State Research Service
United States Department of Agriculture

ANIMAL HEALTH SCIENCE RESEARCH ADVISORY BOARD

Dr. Orville G. Bentley (Chairman)
Science and Education
217W Administration Bldg.
U.S. Department of Agriculture
Washington, DC 20250

Mr. Bert Hawkins (Vice Chairman)
Animal & Plant Health Inspection Service
313E Administration Bldg.
U.S. Department of Agriculture
Washington, DC 20250

Dr. Earl J. Splitter (Executive Secretary)
Cooperative State Research Service
217 West-Auditors Bldg.
U.S. Department of Agriculture
Washington, DC 20251

Dr. David P. Anderson
College of Veterinary Medicine
University of Georgia
Athens, Georgia 30602

Mr. James Egan
6266 Coffeen Street
Farmers Home Administration
Watertown, New York 13601

Dr. David J. Meisinger
National Pork Producers Council
Post Office Box 10383
Des Moines, Iowa 50306

Dr. Richard H. Teske
Center for Veterinary Medicine
5600 Fishers Lane
Food and Drug Administration
Rockville, Maryland 20857

Dr. Travis C. McGuire
College of Veterinary Medicine
Washington State University
Pullman, Washington 99164

Dr. H. Graham Purchase
Agricultural Research Service
Room 207, Building 005, BARC-West
U.S. Department of Agriculture
Beltsville, Maryland 20705

Dr. Donald E. Williams
Hitch Feedyards
Box 1442
Guymon, Oklahoma 73942

Dr. William J. Benton
Agricultural Experiment Station
University of Delaware
Newark, Delaware 19711

Dr. Irvin T. Omtvedt
Agricultural Experiment Station
University of Nebraska
Lincoln, Nebraska 68583

EXECUTIVE SUMMARY

The Animal Health Science Research Advisory Board was established by Public Law 95-113, the Food and Agriculture Act of 1977, to advise the Secretary on the implementation and priorities of animal health research authorized by the Act. This includes two new programs authorizing extramural, Federal support for animal health research -- Section 1433, the Animal Health and Disease Formula Research Program, and Section 1414 (c)(1), Special Research Grants for animal health. Both programs are administered by the Cooperative State Research Service and have received appropriations over 6 consecutive years (Fiscal Years 1979-1984). The Animal Health Science Research Advisory Board has provided consultation and advice essential to the implementation of these programs.

New research under these programs was initiated in Colleges and Schools of Veterinary Medicine, State Agricultural Experiment Stations, and in other cooperating institutions. More than 400 research projects aimed at providing solutions to food animal health problems are being conducted under the Section 1433 Program. Under the Special Research Grant Program, 424 projects have been selected competitively for funding from 2,601 proposals submitted by scientists over a 6-year period. Many of these funded projects are still in progress.

This report summarizes (1) the current status of animal health research programs under Section 1433 and Special Research Grants, (2) 1984 recommendations and actions of the Animal Health Science Research Advisory Board, and (3) specific examples of progress made in research under these new programs.

CONTENTS

ANIMAL HEALTH SCIENCE RESEARCH ADVISORY BOARD
1984 ANNUAL REPORT

I. Current Concerns in Animal Health

Losses from food animal diseases are estimated at $14 billion a year. This touches every person in this nation, rich or poor, since it adds to the first-dollar-cost of food.

Because today we have surpluses, some policymakers may feel that we do not need to address these problems. One can debate how long surpluses will be the order of the day, but the major issue is the unnecessary billions of dollars lost each year because of inadequate technology to correct known problems in animal health.

This country has done a miraculous job in advancing capabilities in human disease prevention, control, and treatment. Past terrifying disease scourges are now eradicated or fully controlled, life can be prolonged by organ transplants, and serious crippling conditions can be corrected. Life is made more pleasant by these great biomedical advances. Ironically, many of the biomedical breakthroughs were made by veterinary scientists working in biomedicine such as the artificial heart of international acclaim which was perfected to a great extent by a veterinarian. These contributions provide indication that very significant advances are possible in animal health--their development depending in large part on the level of resources committed.

The Food and Agriculture Act of 1977 (PL 95-113) recognized significant research opportunities to increase livestock production efficiency and food safety through emphasis on solving animal health problems.

Two new extramural programs were initiated which provide USDA support for animal health and disease research under authorizations of PL 95-113. These are the Animal Health and Disease Research (Section 1433) Formula Program and the Animal Health Special Research Grant Program, (Section 1414(c)(1) amending Public Law 89-106). Provisions of these authorizations for animal health research were further strengthened under amendments included in Public Law 97-98, the Agriculture and Food Act of 1981. The U.S. Department of Agriculture Appropriation Act for Fiscal Years 1979-1985 has provided funds to carry out animal health research provisions of Public Law 95-113 at levels indicated in Table 1.

Table 1

Item	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985
Formula Funds (Sec 1433)	5,000	6,000	6,500	5,760	5,760	5,760	5,760
Spec. Research Grants Animal Health	10,000	7,000	5,050	7,156	7,156	7,156	6,000
Minor Use Animal Drugs	--	--	--	240	240	240	240
Total	15,000	13,000	11,550	13,156	13,156	13,156	12,000

The Animal Health Science Research Advisory Board was established in response to the mandate of Section 1432, Public Law 95-113. In accordance with the provisions of this authorization the Board represents national livestock commodity organizations, State Agricultural Experiment Stations, Colleges and Schools of Veterinary Medicine, and specific Federal agencies responsible for food animal health research and regulatory programs.

II. Status of Programs

1. Section 1433, Animal Health and Disease Formula Program

Program Objectives

The Animal Health and Disease Formula Program (Section 1433) is directed toward improving the health and productivity of animals and the welfare of producers and consumers of animal products; protecting human health through control of animal disease transmissible to humans; minimizing livestock and poultry losses due to transportation and handling; facilitating the effective treatment and prevention of food animal and horse diseases, protecting livestock and poultry from diseases of wildlife; and providing improved methods of controlling birth of predators and other animals.

Approach

Under the Section 1433 formula program, the Department has been able to strengthen its animal health research partnership with the State Agricultural Experiment Stations and to extend this partnership to all Colleges and Schools of Veterinary Medicine. Provisions of Section 1433 are unique in that funds are distributed to the States in relation to a State's livestock importance and its capacity to conduct animal health and disease research. When more than one eligible institution exists within a State, the State's entitlement is distributed to these institutions in accordance with their animal health research capacities. State contributions to expanded animal health research are encouraged through a requirement that each State match any Section 1433 funds received annually in excess of $100,000.

Formula Provisions

Section 1433 provides for support of livestock and poultry disease research in Colleges of Veterinary Medicine and in eligible State Agricultural Experiment Stations. These funds are distributed as follows:

48 percent are distributed in an amount proportionate to the value of and income to producers from domestic livestock and poultry in each State to the total value of and income to producers from domestic livestock and poultry in all States.

Livestock Value (USDA-Data)	24%
Livestock Income (USDA-Data)	24%

48 percent are distributed in an amount proportionate to the animal health research capacity of the eligible institutions in each State to the total animal health capacity in all the States.

Expenditures for Animal Health Research (Eligible Institution Data)	24%
Scientist Years for Animal Health Research (Eligible Institution Data)	24%

Four percent is retained by the Department of Agriculture for administration, program assistance to the eligible institutions, and program coordination.

In a State with two or more eligible institutions, that State's allocation is distributed in the proportion that the animal health research capacities of these institutions bear to the total capacity of the State.

Eligible institutions must provide non-Federal matching funds in States receiving annual amounts in excess of $100,000 under this authorization.

Current Activities (Funding FY 1984 - $5.76 million, FY 1983 - $5.76 million)

Fiscal Year 1984 is the sixth year in which the Section 1433 program was active. Institutions receiving FY 1984 funds include 40 State Agricultural Experiment Stations and 16 Colleges of Veterinary Medicine qualifying individually and 11 such stations and 11 Colleges qualifying as combined institutions.

Recommendations of the Animal Health Science Advisory Board are being followed in program administration by CSRS (i.e., scope and priorities of eligible research, determination of research capacity of eligible institutions, and other questions on program administration). In accordance with advice of the Board, emphasis in this research centers on the solution of high-priority diseases or other animal health hazards in the production of livestock, poultry, and aquaculture species.

Research is in progress on more than 400 projects seeking solutions to infectious and noninfectious diseases or parasite problems of food animals and horses. Strong emphasis is being placed on solution to respiratory, enteric, and reproductive diseases. Other major problems such as mastitis, pseudorabies, brucellosis, and pinkeye are being investigated. New or improved vaccines are being developed to control these diseases and other high priority problems such as bovine leukemia, salmonellosis, bluetongue, and TGE. New medical technology including genetic engineering, monoclonal antibody, and virus fingerprinting procedures are being employed to accelerate needed breakthroughs.

2. Section 1414(c)(1), Special Research Grants in Animal Health

Animal health research under the Special Research Grant Program has placed emphasis on the solution of problems of highest priority and national importance. Grants of up to $150,000 are currently made for funded projects--permitting in-depth studies by some of the Nation's most highly

trained, experienced, and productive animal health scientists. Projects are funded with a single grant and expenditures permitted over a period of up to 5 years depending upon budgets and work plans as presented in the proposal. This Program is administered by the Cooperative State Research Service. Eligible diseases and their priorities are identified annually by the Animal Health Science Research Advisory Board through recommendations from national livestock and poultry commodity organizations and other groups concerned with animal health. A competitive process with peer panel evaluation of proposals has been used in the placement of the majority of grants made under this Program. Peer panel members are selected from a Technical Advisory Committee appointed by the Secretary.

During the 6 years of competition in Animal Health Special Research Grants (1979-1984), there has been a total submission of 2,601 proposals requesting over $340 million; 424 proposals have received awards totaling $41,817,449. Table 2 provides a summary of the awards made by commodity and diseases. Data for 1979 include $505,756 of Special Research Grant funds awarded noncompetitively to 17 State Agricultural Experiment Stations as Supplementary Research Grants.

Current Activities

The 1984 competitive program in Animal Health Special Research Grants again was based on research priorities established by the Board at the October 27, 1983, meeting. A Federal Register Announcement utilized these priorities.

In this year's competition 416 animal health proposals requesting more than $49 million were evaluated in 6 panels. This is about the same number as last year (417). Table 3 summarizes the success rates and funds awarded in the areas of eligibility.

Several suggestions were made during the year concerning the Animal Health Special Research Grants Program. These suggestions and related Board comments are summarized in Section III under Board recommendations.

3. Minor Use Animal Drug Clearance Program

R. H. Teske, Food and Drug Administration, reported to the Board that the Minor Use Animal Drug Clearance Program conducted cooperatively with CSRS under the IR-4 project is moving along very well. One drug has been cleared and the clearance of several others may be possible in the near future. The Center for Veterinary Medicine, FDA, has a strong interest in the Minor Use Animal Drug Clearance Program and has taken a number of steps to facilitate progress: An FDA staff person has been detailed to IR-4 headquarters to provide assistance; a competitive grant program has been initiated to support needed drug clearance research; workshops have been sponsored by FDA to identify priorities and coordinate activities of those engaged in minor use drug clearance; studies are being initiated in response to the Board's recommendation of last year to review comparative drug metabolism data in ruminants in order to facilitate drug clearance for sheep. Similar comparative studies may be made in avian and monogastric species. The minor use animal drug clearance program must be regarded as a long-term activity which will require a substantial budget over time in order to achieve needed results.

4. Comments by the American Veterinary Medical Association, Council on Research

D. K. Sorensen, representing the above Council, reported the concern over low success rates in the Animal Health Special Research Grant Program (16 percent in 1984) as compared to NIH competitive programs which have a success rate of about 30 percent. The basic problem is underfunding of the Animal Health Special Research Grant Program. Priorities are necessary to maximize the use of limited animal health funds in this program. Some concerns about the program are: New emerging diseases may not be covered under restrictive priorities; the state of knowledge about a specific disease should be an important consideration in the process of setting priorities; new research technologies should be used to the maximum extent in projects receiving funds.

The Board accepted a tentative offer from the Council on Research, AVMA, to assemble information on animal health research priorities from various groups and provide an assessment of these priorities for consideration by the Board.

5. Evaluation of CSRS Animal Health Programs

At the 1983 meeting (Minutes, October 27, 1983), the Board recommended that a study be made of accomplishments under the new animal health research programs of CSRS including the identification of needs and priorities for future animal health research. The National Academy of Sciences has agreed to conduct this study and anticipates that it will be completed in April 1986.

6. National Animal Disease Surveillance Program

J. W. Glosser, USDA-APHIS, reported to the Board on the current status of this animal disease detection program. It is being conducted currently on a pilot trial basis in several states and will be expanded as the program develops. A random sample survey is used to obtain estimates of incidence, prevalence, trends, and costs of common diseases of livestock. Information obtained will benefit State/Federal planning and budgeting, research planning and priorities, and implementation of individual herd health plans by livestock owners. It will also put into place a system that will aid in monitoring for foreign animal diseases.

III. 1984 Recommendations of the Animal Health Science Research Advisory Board

In addition to research priorities previously described, the Board considered a number of important issues of animal health and problems or questions related to CSRS animal health programs.

1. Modification in the Animal Health Formula (Section 1433)

Suggestions are made to CSRS from time to time on possible use of revised procedures for calculating the distribution of Section 1433 funds. The

Northcentral (NCA-2) Animal Health Advisory Committee has asked CSRS to determine the impact on this distribution if animal health research expenditures of the eligible institutions were used as the sole measure of "animal health research capacity", excluding "Scientist Year" data currently used in the calculation. Table 4 provides information on such a distribution based on FY 1984 formula data.

A similar request was made by the NCA-2 group concerning the possible inclusion of data on broilers and a second pig crop in "Livestock Values" and the impacts of such inclusion on Section 1433 distribution and on commodity distribution of Animal Health Special Research Grants. Table 5 indicates a theoretical Section 1433 distribution based on this modification.

The Board recommended that no changes be made in the current formula used in distributing Section 1433 funds. Further consideration will be given to the formula by the Board if the Section 1433 program is renewed in the 1985 Farm Bill.

2. Animal Health Special Research Grants

The Board reviewed the list of priorities for Animal Health Special Research Grants and recommended that distribution of funds and eligible areas be revised as listed in Table 6.

Several suggestions were made during the year concerning the Animal Health Special Research Grants Program. These suggestions and related Board comments are summarized as follows.

a. A general category is needed which will include broad areas of important research that do not qualify under the restrictive guidelines currently used.

The Board advised against such a category since it would be open-ended without any kind of needed prioritization within the area.

b. The distribution of funds by commodity importance (value and income) should take into account broilers and a second pig crop which are included under livestock income but not under livestock values (inventory).

The Board reviewed the changes in commodity distribution under such modification (Table 5). It was concluded that the current distribution is equitable and should be continued.

c. Rabbit diseases should be made an eligible area for funding.

The Board believes that the economic importance of rabbit production is not great enough in comparison with the other commodities to establish a separate category for such research. The Board agreed to consider at its next meeting the possibility of a category for diseases of minor animal species.

d. More attention should be directed to the economic aspects of animal health.

The Board agreed that economics is an important consideration in animal health and should be eligible for funding. It was pointed out that such research is eligible and has been funded. The Board recommended that reference be made to this eligibility in the Special Research Grant guidelines.

e. Bovine infectious keratoconjunctivitis (pinkeye) should be included as an eligible area of research under beef cattle diseases.

The Board agreed that this is an important problem, but in view of funding limitations and the desire to avoid further lowering of success rates in proposal funding, the disease was not included.

f. Potomac Fever should receive the highest priority for equine research funding.

The Board recognized that this problem is of great concern to horse owners in the Maryland-Virginia area. Research on the disease is fully eligible under the current guidelines. In view of this fact and the limited funds available in the equine Special Grant category, the Board did not believe it advisable to earmark funds specifically for this disease.

g. The problem of determining productivity on funded projects was discussed with particular reference to peer panel evaluation of subsequent proposals submitted by investigators.

The Board recommended that investigators who received Animal Health Special Research Grant awards in the last 5 years should include with new proposals a summary of progress and list of publications resulting from such grants.

Table 2

ANIMAL HEALTH SPECIAL RESEARCH GRANT AWARDS
FISCAL YEARS 1979-1984

Commodity and Disease	1979, 1980, and 1981 Projects	1979, 1980, and 1981 Funds	1982 Projects	1982 Funds	1983 Projects	1983 Funds	1984 Projects	1984 Funds	Total Projects	Total Funds
Beef Cattle										
Respiratory Diseases	21	$2,694,302	9	$1,027,653	12	$1,157,348	8	$1,151,693	50	$6,030,996
Reproductive Diseases (including Anestrus)	5	741,988	8	868,006	7	900,753	6	760,770	26	3,271,517
Enteric Diseases	15	1,377,858	5	579,600	4	368,889	6	575,847	30	2,902,194
Metabolic Diseases	3	356,850	2	79,500	0	---	0	---	5	436,350
Toxicosis	4	356,162	0	---	1	100,000	0	---	5	456,162
Bluetongue	3	375,360	1	130,847	0	---	1	103,000	5	609,207
Internal Parasites	13	1,495,555	1	80,000	2	258,826	3	287,923	19	2,122,304
External Parasites	6	671,717	2	130,000	2	139,600	1	51,634	11	992,951
Other Diseases	2	100,920	0	---	0	---	0	---	2	100,920
Subtotal	72	8,170,712	28	2,895,606	28	2,925,416	26	2,930,867	153	16,922,601
Dairy Cattle										
Mastitis	13	1,245,270	6	444,200	8	442,663	5	441,200	32	2,573,333
Respiratory Diseases	4	237,545	2	253,400	2	188,653	2	189,085	10	868,683
Reproductive Diseases (including Anestrus)	13	1,317,735	3	381,394	2	213,772	4	378,171	22	2,291,072
Enteric Diseases	3	149,938	3	190,200	2	203,544	1	126,057	9	669,739
Metabolic Diseases	6	502,805	0	---	0	---	0	---	6	502,805
Bluetongue	0	---	0	---	1	132,414	0	---	1	132,414
Internal Parasites	2	73,245	0	---	0	---	0	---	2	73,245
External Parasites	1	58,500	0	---	0	---	0	---	1	58,500
Other Diseases	2	259,837	0	---	1	50,000	1	74,423	4	384,260
Subtotal	44	3,844,875	14	1,269,194	16	1,231,046	13	1,208,936	87	7,554,051

Commodity and Disease	1979, 1980, and 1981 Projects	1979, 1980, and 1981 Funds	1982 Projects	1982 Funds	1983 Projects	1983 Funds	1984 Projects	1984 Funds	Total Projects	Total Funds
Swine										
Enteric Diseases	16	$1,315,870	5	$ 381,800	5	$ 317,969	3	$ 316,350	29	$2,331,989
Respiratory Diseases	4	326,929	3	318,600	3	317,969	3	316,350	13	1,279,848
Reproductive Diseases	1	163,000	2	215,062	2	163,194	3	248,735	8	789,991
Pseudorabies	2	420,038	1	39,638	2	208,498	0	---	5	668,174
MMA	5	374,779	0	---	2	154,083	1	98,851	8	627,713
Internal Parasites	3	318,763	2	140,900	1	30,000	0	---	6	489,663
External Parasites	1	137,980	1	50,000	0	---	0	---	2	187,980
Toxicosis	2	190,064	0	---	1	78,779	4	285,114	7	553,957
Skeletal Diseases (Lameness)	2	193,386	2	127,000	0	---	0	---	4	320,386
Subtotal	36	3,440,809	16	1,273,000	16	1,270,492	14	1,265,400	82	7,249,701
Poultry										
Respiratory Diseases	22	1,392,239	4	346,934	6	454,450	4	352,358	36	2,545,981
Skeletal Diseases	2	173,000	2	254,190	1	146,159	0	---	5	573,349
Enteric Diseases	3	156,280	2	172,100	3	257,008	1	90,741	9	676,129
Neoplastic Diseases (Inc. Marek's Disease)	4	178,560	1	86,076	0	---	1	144,666	6	409,302
Internal Parasites	3	337,850	0	---	0	---	0	---	3	337,850
Toxicosis	4	355,428	0	---	0	---	0	---	4	355,428
Other Diseases	1	113,410	0	---	0	---	2	266,414	3	379,824
Subtotal	39	2,706,767	9	859,300	10	857,617	8	854,179	66	5,277,863

Commodity and Disease	1979, 1980, and 1981 Projects	1979, 1980, and 1981 Funds	1982 Projects	1982 Funds	1983 Projects	1983 Funds	1984 Projects	1984 Funds	Total Projects	Total Funds
Sheep and Goats										
Respiratory Diseases	2	$ 209,281	0	$ ---	0	$ ---	1	$ 77,145	3	$ 286,426
Predator Control	5	351,595	1	30,809	0	---	0	---	6	382,404
Reproductive Diseases	2	75,078	0	---	1	54,842	1	121,000	4	250,920
Bluetongue	1	60,000	0	---	1	100,000	1	122,000	3	282,000
Caseous Lymphadenitis	2	121,158	1	123,179	0	---	0	---	3	244,337
Contageous Ecthyma	1	147,063	0	---	0	---	0	---	1	147,063
Internal Parasites	3	301,956	2	131,509	1	46,591	0	---	6	480,056
Other Diseases	2	35,745	1	36,623	1	120,000	0	---	4	192,368
Subtotal	18	1,301,876	5	322,120	4	321,433	3	320,145	30	2,265,574
Horses										
Respiratory Diseases	5	345,856	1	127,240	2	103,390	1	64,999	9	641,485
Enteric Diseases	1	47,587	0	---	1	110,668	0	---	2	158,255
Musculoskeletal Diseases	3	317,799	0	---	0	---	1	148,201	4	466,000
Internal Parasites	1	142,010	1	87,260	0	---	0	---	2	229,270
Subtotal	10	853,252	2	214,500	3	214,058	2	213,200	17	1,495,010
Aquaculture										
Infectious Diseases	6	559,952	1	107,600	2	107,375	2	106,945	11	881,872
Parasites	2	170,777	0	---	0	---	0	---	2	170,777
Subtotal	8	730,729	1	107,600	2	107,375	2	106,945	13	1,052,649
TOTAL	227	21,049,020	75	6,941,320	79	6,927,437	67	6,899,672	448	41,817,449

Table 3 - Animal Health Special Research Grants, Fiscal Year 1984

Area	Number of Proposals	Proposals Funded	Success Rates	Amount Requested	Amount Granted	
Beef and Dairy Cattle						
Reproductive Diseases	71	11	15%	$8,853,008	$1,241,941	Beef $863,770 Dairy $378,171
Respiratory Diseases	49	10	20%	6,687,179	1,340,778	Beef $1,151,693 Dairy $189,085
Mastitis	23	5	22%	2,645,169	441,200	Dairy $441,200
Enteric and Digestive Diseases	31	7	23%	3,618,245	701,904	Beef $575,847 Dairy $126,057
Parasites and Metabolic Diseases	42	4	10%	5,083,801	339,557	Beef $339,557
Foot Rot	2	1	50%	296,332	74,423	Dairy $74,423
Swine						
Enteric Diseases	25	3	12%	3,055,052	316,350	
Respiratory Diseases	12	3	25%	1,420,265	316,350	
Reproductive Diseases	13	4	31%	1,422,760	292,350	
Other Swine Diseases	18	4	22%	2,130,090	340,350	
Poultry						
Respiratory Diseases	30	4	13%	3,044,409	352,358	
Metabolic and Immunologic Diseases	24	3	13%	2,671,630	411,080	
Enteric Disorders	13	1	8%	1,370,271	90,741	
Sheep and Goats	32	3	9%	4,072,127	320,145	
Horses	24	2	8%	2,384,083	213,200	
Aquaculture	7	2	29%	558,368	106,945	
TOTAL	416	67	16%	$49,312,789	$6,899,672	

Table 4 - Impacts on Section 1433 Allocations with Research Expenditures as the Measure of "Animal Health Research Capacity" Based on Fiscal Year 1984 Formula

Total Dollars Shifted: $119,042

States Gaining:

$10,000 or more - 4 States (IA, NY, WA, WI)
5,000 to 10,000 - 3 States (FL, LA, OH)
1,000 to 5,000 - 7 States (AK, ID, NE, NJ, OK, OR, UT)
1 to 1,000 - 5 States (DE, ME, NV, NC, RI)

States Losing:

$10,000 or more - 2 States (CA, SD)
5,000 to 10,000 - 6 States (AL, KY, MA, MD, MN, MS)
1,000 to 5,000 - 15 States (AR, CO, CT, GA, IL, IN, KS, MI, MO, MT, NH, ND, PA, VA, WY)
1 to 1,000 - 8 States (AZ, HI, NM, PR, SC, TN, TX, WV)

continued

Table 4 (continued)

State	Percent of Research Expenditures	Allocation of $2,748,211	Dollar Change
AL	2.6183	71,956	-9,043
AK	.5756	15,818	+2,162
AZ	.9401	25,836	-636
AR	.8695	23,896	-3,034
CA	8.5218	234,197	-20,857
CO	6.5817	180,880	-3,285
CT	.6084	16,720	-1,242
DE	.3954	10,866	+382
FL	2.7058	74,362	+5,232
GA	4.1891	115,126	-1,804
HI	.1390	3,820	-154
ID	1.7755	48,794	+4,345
IL	3.0069	82,636	-3,434
IN	2.2267	61,194	-1,795
IA	4.8759	134,000	+19,819
KS	2.2076	60,670	-4,198
KY	1.3554	37,250	-6,228
LA	3.4789	95,608	+5,193
ME	.4107	11,286	+340
MD	.8650	23,772	-6,181
MA	2.1070	57,904	-5,542
MI	2.1717	59,684	-2,724
MN	2.4426	67,128	-8,720
MS	.7142	19,628	-8,001
MO	1.7809	48,944	-1,769
MT	1.0141	27,870	-4,247
NE	1.5824	43,488	+2,039
NV	.3503	9,628	+534
NH	.2727	7,494	-1,227
NJ	.8831	24,270	+2,417
NM	.3086	8,482	-212
NY	7.7097	211,878	+23,839
NC	1.8223	50,080	+534
ND	.6801	18,690	-3,342
OH	3.1322	86,080	+7,602
OK	1.4133	38,840	+3,456
OR	2.5418	69,854	+1,282
PA	3.4037	93,540	-3,187
PR	.0573	1,588	-691
RI	.5146	14,142	+227
SC	.2772	7,618	-587
SD	.3430	9,426	-10,346
TN	1.0736	29,504	-692
TX	3.4820	95,692	-356
UT	1.6514	45,384	+3,314
VT	.1894	5,206	0
VA	1.6178	44,460	-1,968
WA	4.2912	117,932	+10,608
WV	.2315	6,362	-19
WI	3.1190	85,716	+25,717
WY	.4735	13,012	-3,521

Table 5 - Impacts on Section 1433 Allocations under "Livestock Values" with such "Values" including Broilers and a Second Pig Crop

Fiscal Year 1984 Formula Data

Methodology

Column A - Section 1433 distribution calculated as required under present guidelines.

Column B - Theoretical distribution using "Livestock Value" data as required, but with the addition of broiler income and a second pig crop (December-May).

Total Dollars Shifted: $72,169

States Gaining:

$10,000 or more	- 2 States (AR, GA)
5,000 to 10,000	- 4 States (AL, IA, MD, NC)
1,000 to 5,000	- 6 States (DE, IL, IN, ME, MS, VA)
1 to 1,000	- 2 States (LA, SC)

States Losing:

$10,000 or more	- None
5,000 to 10,000	- 2 States (TX, WI)
1,000 to 5,000	- 19 States (AZ, CA, CO, ID, KS, KY, MI, MO, MT, NE, NM, NY, ND, OK, OR, SD, UT, WA, WY)
1 to 1,000	- 16 States (AK, CT, FL, HI, MA, MN, NV, NH, NJ, OH, PA, PR, RI, TN, VT, WV)

continued

State	A Livestock Value 1984 Distribution $1,374,106	B Livestock Value Adjusted for Broilers/Pigs Theoretic Distribution $1,374,106	Dollar Change
AL	$17,819	$26,316	+8,497
AK	175	159	-16
AZ	12,467	11,222	-1,245
AR	21,121	32,980	+11,859
CA	75,958	71,650	-4,308
CO	33,693	30,215	-3,478
CT	2,625	2,329	-296
DE	717	4,929	+4,212
FL	24,507	23,872	-635
GA	21,554	32,946	+11,392
HI	2,679	2,534	-145
ID	22,086	19,599	-2,487
IL	39,636	43,011	+3,375
IN	27,811	30,002	+2,191
IA	98,233	106,067	+7,834
KS	56,586	52,017	-4,569
KY	29,079	26,986	-2,093
LA	14,425	15,008	+583
ME	3,144	4,565	+1,421
MD	7,501	12,877	+5,376
MA	2,295	2,068	-227
MI	23,690	22,043	-1,647
MN	58,099	57,945	-154
MS	17,288	21,851	+4,563
MO	58,876	57,380	-1,496
MT	30,354	26,987	-3,367
NE	76,424	72,527	-3,897
NV	6,524	5,764	-760
NH	1,525	1,355	-170
NJ	2,478	2,214	-264
NM	14,109	12,498	-1,611
NY	33,907	30,010	-3,897
NC	17,139	26,272	+9,133
ND	21,846	19,585	-2,261
OH	28,455	27,624	-831
OK	47,752	43,327	-4,425
OR	19,479	17,815	-1,664
PA	36,107	35,280	-827
PR	6,607	6,179	-428
RI	214	194	-20
SC	7,625	8,111	+486
SD	45,111	41,855	-3,256
TN	26,446	25,810	-636
TX	123,885	115,223	-8,662
UT	10,904	9,650	-1,254
VT	6,772	5,995	-777
VA	20,294	21,541	+1,247
WA	19,625	17,972	-1,653
WV	6,277	6,082	-195
WI	77,203	70,431	-6,772
WY	14,980	13,234	-1,746

Table 6 - Animal Health Special Research Grants
Fiscal Year 1985 Priorities

		Percent of Commodity
3.1	Beef Cattle 41.73 percent of Funds	
	(1) Respiratory disease complex. (16.69 percent of available funds)	40
	(2) Reproductive diseases, especially brucellosis and including but not limited to anestrus, leptospirosis and vibriosis. (12.52 percent of available funds)	30
	(3) Enteric diseases. (8.35 percent of available funds)	20
	(4) Parasites (internal & external) including but not limited to anaplasmosis, ticks, flukes, nematodes and interactive effects of internal and external parasites. Metabolic diseases, especially bloat, grass tetany, and mineral imbalances. (4.17 percent of available funds)	10
3.2	Dairy Cattle 18.27 percent of Funds	
	(1) Mastitis. (Approximately 6.40 percent of available funds)	35
	(2) Reproductive disease, including but not limited to brucellosis and nondetected estrus. (5.48 percent of available funds)	30
	(3) Respiratory diseases. (2.74 percent of available funds)	15
	(4) Digestive and enteric diseases, including but not limited to Johne's Disease. (1.83 percent of available funds)	10
	(5) Johne's Disease. (1.82 percent of available funds)	10
3.3	Swine 18.34 percent of Funds	
	(1) Enteric diseases. Viral enteritis, coccidiosis, salmonellosis, clostridium, dysentery, and proliferative enteritis. (4.59 of available funds)	25

	Percent of Commodity
(2) Respiratory diseases. Hemophilus pleuropneumonia, mycoplasma pneumonia, atrophic rhinitis, pasteurella multocida, influenza, Pseudorabies, and haemophilus parasuis (4.59 of available funds)	30
(3) Reproductive diseases. Parvovirus, MMA, leptospirosis, streptococcus, and pseudorabies. (4.58 percent of available funds)	25
(4) Others. Trichinosis, mycotoxicosis, pseudorabies, lameness, eperythrozoonosis, and parasites. (4.58 percent of available funds)	20

3.4 Poultry 12.38 percent of Funds

(1) Respiratory diseases. (4.95 percent of available funds)	50
(2) Metabolic and immunologic diseases. (3.72 percent of available funds)	30
(3) Enteric disorders. (3.71 percent of available funds)	20

3.5 Sheep and Goats

Bluetongue, foot rot, chlamydial polyarthritis, gastrointestinal parasites, caseous lymphadenitis, pneumonia, mastitis, bacterial scours, ram epididymitis, and predator control.
(4.64 percent of available funds)

3.6 Horses

Especially respiratory diseases, and including but not limited to enteric diseases, reproductive diseases, and musculoskeletal diseases (especially laminitis and lameness).
(3.09 percent of available funds)

3.7 Aquaculture

Infectious diseases and parasites.
(1.55 percent of available funds)

IV. Selected Examples of Progress in Animal Health Research

Some examples of progress were selected from reports submitted by investigators of projects that received support from Section 1433 (Formula) and Section 1414(c)(1) (Animal Health Special Research Grant) funding. The research work on many of these projects has not been completed. Examples were selected from animal health and disease research projects involving cattle, swine, poultry, sheep, goats, horses, and aquaculture.

Index

General

Engineering Disease Resistant Animals

A multi-State, multidiscipline approach is in progress in genetic engineering that now appears will lead to the identification of genes controlling disease resistance and their eventual isolation and use in producing disease resistant animals. In addition to CSRS animal health support, funds for this work are derived from Hatch, State appropriations, Federal funds other than CSRS, industry, and other sources.

Scientists in six States (CA, IA, NY, TX, WA, WI) are determining the identity and location of genes in livestock and poultry which control resistance to specific diseases. University of Pennsylvania, Texas, and Minnesota scientists are developing techniques for insertion of animal genes into embryos.

In a closely related activity, California, Colorado, Louisiana, and Texas scientists have been developing methods for the rapid propagation of genetically superior animals. Techniques which have been developed include methods for nonsurgical collection and transfer of embryos, methods for freezing and storage of embryos, methods to cut early embryos into two or three pieces to produce identical twins or triplets, methods to sex the embryos, and a general ability to do microsurgery on the 1-to-128-cell developing conceptus. The development of these procedures is important for two reasons: 1) if genes for disease resistance or other important economic traits can be isolated, it is likely that microsurgical procedures will be required to insert them into the embryo; and 2) once a genetically engineered animal has been developed which has an important economic trait, such as resistance to a disease, it will be most beneficial to rapidly propagate this individual. The procedures which have been developed will allow this very rapid propagation. The usefulness of these procedures is not limited to genetically engineered animals. If individual animals can be identified that are already resistant to certain diseases, they can be used to rapidly develop a strain of resistant animals much the same as has been done with plants.

New Test Determines the Sex of Embryos

Immunological techniques that are being used so successfully to improve animal disease diagnosis and treatment, now are making possible other major developments to improve animal production. California scientists have developed immunological techniques to determine the sex of embryos before they are implanted in the uterus of the mother. Specifically, these researchers have developed an antibody from mice which can recognize a "male-specific" factor on the surface cells in the early mouse or bovine embryo. In mice trials, sexed embryos survived to term as did controls, but the sex ratio was approximately 80/20 in favor of the diagnosed sex. The test was slightly more accurate for female embryos. Further studies are determining accuracy in sexing bovine embryos, and to improve this accuracy, hybridoma-monoclonal antibody procedures will be used.

Successful sexing of bovine embryos prior to transfer to recipients offers the promise of reduced cost of multiplication of valuable breeding stock. Currently, genetically superior animals are superovulated, bred, and their embryos collected only to have about half of these embryos result in an offspring of undesired sex. This new technology can substantially reduce this wastage.

Progress in the Minor Use Animal Drug Clearance Program

Very few drugs are available for approved use in treating diseases and parasites of minor species of animals such as sheep and goats, rabbits, game birds, etc. The cost to commercial companies of obtaining data needed to clear such drugs by the Food and Drug Administration (FDA) exceeds what might be expected in sales income. The Animal Health Science Research Advisory Board took a major step toward solving this problem with the recommendation in 1980 that some Animal Health Special Research Grant funds should be used in a pilot trial of minor use drug clearance. CSRS utilized the IR-4 (Minor Use Pesticide Clearance) system in implementing this pilot trial and subsequent studies. The Food and Drug Administration has provided excellent cooperation in contributing scientific effort, research funding, and regulatory provisions that will facilitate this Program. As a result, major progress has been achieved in preliminary FDA approval of thiabendozol for the treatment of gapeworms in pheasants. In a related action, one drug, lasolocid, has been approved by the FDA for treating coccidiosis in sheep. Work toward clearances is proceeding on a number of other minor use drugs.

Progress in Developing Rapid Tests for Pesticides and Drugs

The accurate detection of pesticides and drugs in animals and animal products requires laborious, time-consuming, and costly chemical analysis. California scientists are studying immunologic methods which could greatly reduce the difficulties associated with detection by chemical tests. The major problem to overcome is the basic fact that chemicals and drugs do not stimulate an immunologic response in an animal as do foreign proteins. In the California studies this problem is being overcome by the successful binding of a protein to a pesticide and in another instance by the linking of a protein to a drug used for internal parasite control. These protein-linked chemicals and drugs successfully produced immunologic reactions in rabbits. Further studies are in progress to verify the specificity of the reactions which, if successful, will assure the development of the needed new tests.

Improved Method for Treating Leg Wounds of Livestock

Scientists in the Tuskegee Institute School of Veterinary Medicine have developed a treatment procedure which can hasten the healing of leg wounds of livestock. Wounds of the lower limbs in livestock occur quite frequently and very often fail to heal properly due to the tight adherence of the skin to underlying structures. Such wounds heal slowly and are accompanied by excessive fibrous tissue proliferation and eventual marked scarring. The new procedure involves repair of wounds by undermining the skin adjacent to the margin of the wound before closure and bandaging over the defect. By this procedure, less serious wounds healed in two 2 weeks with excellent hair-growth and cosmetic results.

New Tests for Rapid Diagnosis of Livestock and Poultry Diseases

Research in 18 States, including extensive work in California, has centered on the development of new diagnostic procedures for animal diseases which are reliable, fast, and relatively inexpensive. These tests--called enzyme-linked immuno assays (ELISA)--are being used for the rapid detection of viral, bacterial, and parasitic agents such as infectious bovine rhinotracheitis, bovine viral diarrhea, infectious bronchitis (chickens), and cysticercosis. The general availability of these procedures has made it possible to detect the causative agents of diseases much more rapidly and more simply, resulting in more efficient treatment of the diseases. In addition, these procedures have proven extremely useful for studies designed to elucidate the routes of infection and the actual vectors of many diseases. This general approach represents a major breakthrough in our ability to diagnose the causes of disease and to study the mechanisms of pathogenicity of many disease agents.

Prevention of Lead Poisoning

Texas scientists have found that thiamin (vitamin B_1) has a marked effect on the absorption and body distribution of lead. This information holds great impact for a large segment of the world's human and animal populations where diets are largely deficient in this vitamin and where exposure to lead is not uncommon. Researchers are in the process of seeking the mechanisms for this interaction and measuring biochemical and morphological parameters to better define the interrelationships. The results indicate that large doses of thiamin are effective in helping to retard the absorption of lead and also appear to be beneficial in the treatment of animals exposed to this toxic metal. Information of this nature where safe and simple measures may be taken to retard the exposure to environmental toxicants has high value for both human and animal populations.

Cattle

Respiratory Diseases

Bovine Respiratory Syncytial Virus Found to be Widespread in Southeastern U.S. Cattle - Respiratory disease in cattle has been estimated to cost the American farmer at least $150 million annually. In spite of control measures which are available for some infectious agents associated with bovine respiratory disease, there is no solid evidence of prevention or control of this syndrome. Recently, researchers at the University of Georgia showed that respiratory syncytial virus (BRSV) is active in outbreaks of fatal pneumonias in beef and dairy herds. Furthermore, antibodies to BRSV have been found in 65 percent of cattle in the Southeast which indicates it is a serious, unrecognized problem. To date, no vaccine for BRSV is available commercially. The results of current University of Georgia experiments indicate the method of vaccination may require an unusual or novel approach since transferable (serum/colostral) antibodies are non-protective. However, prevention appears feasible because cattle that recover from BRSV infection are resistant to reinfection. One of the benefits derived from the current research is more accurate diagnosis of BRSV, and future investigations will be aimed at developing rapid diagnostic methods.

Animal Stress Protection. Research at the Oklahoma State Agricultural Experiment Station has demonstrated that the use of an ionophore for coccidiosis control in newly-arrived cattle cut morbidity by 17 percent (projected annual value of over $14 million to Oklahoma cattlemen). Scientists also demonstrated that the use of mass-medication on arrival can reduce morbidity to 43 percent of that in the conventionally treated cattle. Results indicate the potential to save over half the money presently spent on death losses and morbidity. They also indicate that the cost of the mass-medications used can be recovered in improved feed efficiency and rates of gain (about $28 million savings to Oklahoma cattlemen). The research and management practices demonstrated are widely followed and adapted by Oklahoma cattlemen.

It is estimated that 2-5 percent of newly-received calves or stocker cattle received in Oklahoma die of stress related diseases ($15 million), primarily Bovine Respiratory Disease (BRD) complex shortly after arrival. Morbidity ranges from none up to 100 percent, with the average estimated to be 25-30 percent ($50 million). Oklahoma cattlemen spend about $12 per head on shipped-in cattle for processing and treatment of sick animals ($50 million). Thus, shipping fever causes losses and expenditures of about $83 million per year in Oklahoma--above and many times that nationwide.

Mastitis

Progress in Mastitis Research. Mastitis continues to be the most costly disease of dairy cattle with annual losses exceeding $1.4 billion. Basic research on the mechanisms by which disease is produced and the process of resistance to the disease is believed to offer the greatest opportunities for long-range solutions to this problem. In this connection Illinois scientists have found that milk prostaglandins and thromboxanes appear to play a role in the inflammation in acute coliform mastitis. Illinois College of Veterinary Medicine workers detected an increase in both prostaglandins (F_2 alpha) and thromboxan (B_2) concentrations following inoculation of bovine mammary glands with an *E. coli* endotoxin. Systemic and local inflammation which developed following inoculation with the endotoxin was associated with increased prostaglandins. Treatment with a prostaglandin synthetase inhibitor prevented the anticipated rise in body temperature and clinical signs of quarter inflammation associated with coliform-induced mastitis. This finding helps explain the process of tissue damage and generalized illness occurring in acute mastitis and offers possibilities for more effective treatment.

Nutrition Linked to Prevention of Mastitis. Mastitis can be caused by many different kinds of bacteria some of which are almost universally present in dairy herd environments. In a search for ways to protect cows against mastitis losses, Ohio scientists have discovered that there are nutritional factors important in protecting the mammary gland against infectious organisms in the environment.

The Ohio scientists found that vitamin E and selenium maximized protection during the cows' dry period. Cows are most vulnerable to the entrance of infective agents at the beginning and end of the dry period, and these disease agents later result in mastitis and lower milk production. About 700 mg of vitamin E (alpha tocopherol) and 50 mg of selenium (a single injection 21 days before freshening) were found to reduce the number of clinically affected

quarters by 36 percent and reduce the duration of infection 67 percent during the subsequent lactation. This amount of vitamin E is similar to the amount in 22 pounds of freshly cut alfalfa hay. This is the first documentation linking nutrition to mastitis.

Cause of Udder Edema in Dairy Cattle Found. Research conducted at the College of Veterinary Medicine, Kansas State University, has shown that dairy cows which develop udder edema at the time of calving are suffering from a blood circulatory problem at the mammary gland. It has been shown that blood flow to the mammary gland naturally increases quite dramatically associated with pending parturition, but the venous drainage from the mammary gland is not adequate to take care of this increased blood flow. This results in increased blood pressure within milk veins. Because of this finding, research can be directed toward drugs which will reduce blood pressure and assist in blood flow drainage from the mammary gland. The problem of udder edema is significant because 96 percent of the dairy heifers at parturition have some detectable edema at first calving, while 81 percent of the cows have some degree of udder edema at later calvings. Fortunately not all animals need treatment because the severity of the condition varies, but some dairy cows (usually high milk producing dairy cows) will have a marked udder edema which can predispose them to severe discomfort, trauma, teat injury, and mastitis. It is also a difficult problem to do a thorough job of milking cows with edematous udders.

Parasites

New Method Found to Control Livestock Parasites. Mississippi State Agricultural Experiment Station scientists have discovered a new method for reducing losses due to internal parasites in cattle. A dye, erythrosin B, has been found to have a detrimental effect on the maturation processes of gastrointestinal parasites of cattle by making them photosensitive to sunlight. After the parasites and their eggs are passed from the animal to the environment, they become photosensitive to sunlight. The degree of acquired photosensitivity represents an excellent potential for controlling the level of infected pastures and lots. Cattle acquire internal parasites principally from infected pastures and lots. The elimination of this source of infection would provide a very effective means of control. Losses due to internal parasites are among the most costly factors affecting livestock production and are estimated to exceed $1 billion annually.

Immunity to Toxoplasma. Researchers at the Montana State Agricultural Experiment Station have reported a new assay to elaborate the immune status of animals against toxoplasmosis. Toxoplasmosis, a parasitic disease associated with abortions and fetal anomalies, has been reported to be endemic in certain sheep flocks and cattle herds. In the past the only way to assess whether the animals had encountered the parasite was via a test which did not reveal the immune status of the animal. The new test indicates whether the animal can successfully combat active infection. Thus, examination of food animals prior to pregnancy may be used to increase calf/lamb productivity.

Tick Resistance in Livestock. Although a few breeds of livestock are known to be more resistant to tick infestations than most, little has been known until recently about the mechanisms of this resistance or about acquired resistance. University of North Dakota scientists have found that solid resistance to tick infestations can be induced in animals by the administration of extracts from certain tick tissues or tissue culture. The most promising

approach is in the use of antigens derived from tick tissue cultures. Significant tick resistance in immunized animals is expressed by the death of ticks at their attachment sites on the host and by reduced engorgement weights and egg laying of female ticks. Evidence obtained suggests that animal resistance acquired against one species of tick will provide protection against some other species. In related studies, the North Dakota scientists have found that tick antigens impair the cellular immune response of animals. This impairment may operate to facilitate the transmission of tick-borne diseases. These studies offer hope for the eventual development of nonchemical biological methods of controlling tick infestations and tick-borne diseases in livestock.

New Diagnostic Test for Early Detection of Liver Fluke Infections. Oregon researchers in the School of Veterinary Medicine have developed a Dot-ELISA diagnostic test which is capable of reliably detecting liver fluke infections earlier than other available tests. Liver flukes are one of the most debilitating and common parasitic diseases of livestock and cost the industries millions of dollars each year in lost revenues. The Dot-ELISA is a rapid test that is visually read and, thus, can be easily adapted for field diagnostic use. Because Dot-ELISA can detect fluke infections a month to 6 weeks earlier than other tests, therapy can begin prior to the occurrance of extensive liver damage. Not only is this of considerable importance in directly reducing damage to the parasitized animals, but also makes it possible to interrupt the fluke cycle prior to their reinfecting pasture lands each season. This directly reduces the parasite exposure of livestock on grazing lands.

Tick Studies to Aid Anaplasmosis Research. Researchers at Oklahoma State Agricultural Experiment Station have determined most of the developmental cycle of *Anaplasma marginale*, the causative agent of bovine anaplasmosis, in its biological vector, the tick. Development of the organism was found to be complex involving several stages. Understanding the development of *A. marginale* will undoubtedly enhance attempts to grow the organisms in cell culture. Production of large numbers of organisms in cell culture may enable researchers to develop new ways of detecting infected cattle and to produce a more effective and safe vaccine.

Other Diseases

Vesicular Exanthema-like Agent Found in Cattle. Scientists at the Oregon State University, School of Veterinary Medicine, have found that a virus indistinguishable from the exotic agent causing vesicular exanthema of swine has infected calves under conditions of natural exposure. This newly discovered virus causes lesions in swine typical of vesicular exanthema and establishes a persistent infection in calves. A highly virulent form of the virus was eradicated from the United States in a nationwide effort that cost $39 million. There have been no further outbreaks since the end of this eradication program in 1956.

The Oregon discovery of cattle as a new domestic livestock host and possible reservoir for a vesicular exanthema-like virus is extremely important in helping develop measures to protect the swine and now, perhaps, the cattle industries in the United States from the possible spread of viruses indistinguishable from foreign animal disease agents.

Progress in Fescue Poisoning Research Texas Agricultural Experiment Station scientists have successfully developed a rat model to screen fractions of fescue grass for toxins. Fescue grass accounts for some 14 million acres of improved pasture in the Southeastern USA; however, toxic substances in this grass cost producers approximately $10 million per year. In order to identify the toxic factors, an animal model for bioassay is necessary. Attempts to produce this model have previously been unsuccessful. This model will be used in studies to 1) determine the chemical structure of the toxic factors, 2) to determine this mechanism of action, and 3) to suggest mechanisms of control. It is anticipated that this research will both improve the annual income to farmers and increase the production of a high protein food supply.

New Procedures to Control Cancer-Eye in Cattle. Cancer-eye is one of the most common malignancies of cattle, being second only to bovine leukemia in frequency of occurrence. Significant economic loss results not only from condemnation or reduction in salvage value of carcasses, but from a shortened life span. Colorado State Agricultural Experiment Station scientists have been comparing the effectiveness of surgical removal versus hyperthermia in treatment of early cancer-eye tumors. One-hundred and eight cancer-eyes were treated with a special device to induce hyperthermia in the tumor tissue. Another 100 cases in these same herds were treated with the usual surgical procedures. The hyperthermia treatment resulted in 92 percent overall effectiveness compared to 46 percent with surgery. The new method used in early cancer-eye cases (before the tumors exceed 2 centimeters in diameter) offers excellent promise of effective control.

A New Test for Animal Disease Diagnosis and Research: Application in Bovine Leukemia. California and Washington scientists have collaborated to develop a monoclonal antibody test that will accurately identify T and B cell lymphocytes in cattle. These cells are essential in the process of disease resistance in animals. The new test is easier to conduct, more reproducible, and better suited for testing large numbers of animals than previous T and B cell tests. It provides a valuable new diagnostic and research tool to study the pathogenesis of many important livestock diseases. In applying the test to bovine leukemia, the California scientists found that abnormally high levels of B cells in cattle are associated with infection with bovine leukemia virus. As a result of these studies, it has been concluded that the test will detect subclinical cases of bovine leukemia and for the first time allows early identification of animals holding the greatest risk of developing tumors. Genetic selection by bovine lymphocyte antigen typing could be used to introduce and maintain genetically resistant animals in highly infected herds, thus reducing economic loss from leukemia due to decreased productivity and tumors.

Swine

Swine Dysentery

New Test to Control Swine Dysentery. Auburn University scientists have developed a diagnostic test that shows a high degree of accuracy in detecting swine that are carriers of Treponema hyodysenteriae, the organisms

causing swine dysentery. This disease is estimated to cause annual losses of about $150 million. Presently, there are no reliable means of detecting asymptomatic carriers of swine dysentery, and it is generally believed that the most common way the disease is introduced into herds is by these carriers that show no visible signs of the disease. The new test has been found to correctly identify almost 95 percent of swine carriers of the dysentery organism. The test will be of significant value in controlling the spread of the disease and in disease eradication efforts.

Swine Dysentery Control. Iowa State Agricultural Experiment Station scientists are studying a by-pass loop system in the large intestine of pigs which has been used to detect antibodies against a bacteria which causes swine dysentery. One such antibody was able to kill the causative bacteria of swine dysentery and could lead to rapid development of a vaccine against a disease which currently kills approximately 80 percent of infected pigs. This technology opens the way for similar advancements in intestinal bacterial infections in other animals including humans.

The Cause of Agalactia in Swine Determined

Illinois College of Veterinary Medicine scientists have solved the perplexing question of why sows often fail to produce milk after farrowing. This is referred to as agalactia, and the resulting malnourished baby pigs usually die. These scientists have found that sows become infected with a common bacterium, Escherichia coli, which then releases a toxin into the sow's blood system. This toxin suppresses lactation through its action on prolactin, a hormone which is essential for milk secretion in the sow. Agalactia is a widespread problem, as many as 17 percent of the deaths of baby pigs prior to weaning are due to this disease. The Illinois discovery which identifies the cause of this disease provides a basis for more effective prevention and treatment.

Progress in Pseudorabies Research

Pseudorabies is a widespread, serious problem in swine production causing heavy losses of baby pigs in affected herds. Costs exceed $25 million a year. Vaccination is recommended only when necessary due in part to problems created for control programs in identifying reactors caused by natural infection and those created by the vaccine. Scientists in Iowa State University College of Veterinary Medicine have developed an effective subunit vaccine for pseudorabies that is not only safe for use in swine herds, but with a complementary diagnostic test developed by these scientists, permits differentiation of vaccinated swine from those naturally infected. This vaccine and diagnostic antigen will allow swine producers to have the benefits of pseudorabies vaccination, but at the same time have the ability to detect serologically those vaccinated swine that are carrying virus. This is the first such virus vaccine-diagnostic antigen pair that is compatible with disease eradication programs by serologic testing in any species.

New Diagnostic Method for Osteochondrosis in Swine

A new technique, radionuclide joint-imaging, was successfully utilized by University of Illinois, College of Veterinary Medicine, scientists to detect early lesions of osteochondrosis, a cause of leg weakness and lameness in

swine. These researchers were able to confirm early evidence of bone changes in live swine prior to clinical evidence of osteochondrosis, a disease usually identified at slaughter. The results of joint-imaging were correlated with microscopic lesions in long bones early in the disease. It is hoped that further development of this technique will make it possible to detect early lesions which will provide a means to identify the breeding swine free of potential osteochondrosis lesions.

Studies on Coccidiosis in Swine

Studies by Iowa College of Veterinary Medicine scientists on pigs infected with Isospora suis, a cause of neonatal pig diarrhea, suggest clinically recovered pigs may become asymptomatic carriers of the infection. These scientists found that pigs infected at 1 day of age shed large numbers of I. suis in their feces for approximately 2 weeks after infection, then continued to shed low numbers for at least 10 months as detected by examination of pooled fecal samples at 2- to 4-week intervals. However, prolonged shedding of I. suis did not occur in all recovered pigs. If asymptomatic carriers of I. suis occur, they may serve as a continual source of infection to others, and their identification and elimination from a herd may facilitate control of the disease.

Poultry

Respiratory Diseases

Prevention of Egg Production Losses from Respiratory Disease. Georgia scientists have developed a live vaccine and a killed bacterin, both of which are effective in reducing respiratory disease losses due to Mycoplasma gallisepticum in commercial egg producing flocks. Disease caused by this microorganism is common in commercial egg producing flocks causing an annual loss of about 20 eggs per chicken or a total of $97 million. Infected breeding flocks may need to be slaughtered to control the disease. The new vaccines not only reduce losses, but also prevent egg infection--the usual route of transmission to new flocks. This indicates that long-term use of these products may aid in the eradication of the disease from poultry farms.

Vaccine for Colibacillosis in Poultry. Highly immunogenic Escherichia coli cellular and subcellular (pilus) vaccines against colibacillosis in poultry have been developed by the research workers at the Texas A&M University. Vaccinated chickens were protected against active respiratory infection. These chickens a) gained weight comparable to unvaccinated, unchallenged chickens, b) suffered no morbidity or mortality, c) had no gross lesions, and d) did not harbor E. coli in heart blood, pericardial sac, livers, or air sac. Unvaccinated challenged chickens had severe respiratory distress, suffered 36 percent mortality, and had average air sac, pericardial sac, and liver lesions scores significantly different from both the vaccinated and negative control chickens. Only the challenge strain of E. coli was isolated from the affected tissue. These findings will have substantial impact on colibacillosis--an economically devastating respiratory disease of chickens and turkeys.

Antibiotic Therapy

Tetracycline antibiotics are widely used to treat infectious disease but their oral absorption can be decreased by certain metals (calcium, magnesium, iron, etc.) found in drinking water. Research at Iowa State University has demonstrated that citric acid has the ability to bind these metals thereby increasing the absorption and consequently the blood levels of chlortetracycline. The practical aspects of combining citric acid and the tetracyclines in the drinking water to treat infectious disease is currently under study. Results thus far indicate that turkeys infected with Pasteurella multocida, to produce fowl cholera have higher blood levels of chlortetracycline than noninfected controls when both groups were orally dosed with equal amounts of a citric acid-chlortetracycline combination. Continued research aims are to determine the importance of water quality on the absorption and effectiveness of therapeutic drugs.

Disease Resistance

The immune system of chickens does not respond to its maximum until about the fourth week of age. As a result of this deficiency, immune protection from vaccines or natural exposure often is inadequate during the first few weeks of life. Scientists in the University of Georgia, College of Veterinary Medicine, are searching for ways to overcome this problem. Encouraging results have been obtained by treatment of chicks with a synthetic androgen analog. This treatment causes early migration of bursal lymphocytes (cells essential to certain disease resistance processes) and enhances antibody responses to a number of test antigens. Additional tests will evaluate responses to a number of viral and bacterial pathogens of chickens. The development of effective and practical methods of improving the immune response in young chicks will do much to eliminate some of the problems which presently occur in poultry vaccination programs.

Sheep and Goats

New Test Developed to Detect Bluetongue

Using recombinant DNA technology, University of Alabama scientists have developed a diagnostic test that is group specific in detecting bluetongue virus infections. The test can easily identify sheep harboring known bluetongue virus serotypes. In cooperation with Japanese scientists, the Alabama scientists have been able to test 16 South African and 2 Australian bluetongue virus serotypes. The test successfully detected all of these virus strains. Bluetongue is widespread in sheep in this country and may cause mortalities ranging from 5 to 30 percent. Cattle may be inapparently infected or they may develop clinical signs of the disease. The new test should be particularly valuable in rapid diagnosis of the disease and in assuring that animals for export, particularly cattle, are free of the disease.

Progress in Controlling Footrot in Sheep

Idaho researchers are very encouraged with results from tests of a vaccine for the treatment of footrot in sheep. This disease is estimated to cost Idaho sheep producers over $1 million per year.

Two subcutaneous injections at a one-month interval were able to completely clear or reduce severe cases of footrot.

Compared to daily footbathing using 10 percent $ZnSO_4$ and monthly trimming (no vaccination), only 40 percent of severely affected sheep were cleared. Those which still had the disease had moderately severe lesions, but they were generally restricted to just one foot.

Vaccination alone obviously was not 100 percent effective as a treatment. However, animals used in this trial were some of the worst possible cases. All animals responded to some degree and only half the animals and 20 percent of the feet had to be individually handled and treated at the end, reducing labor costs and time by more than two-thirds.

Guard Dogs for Protection of Sheep Against Predators

Massachusetts scientists have completed an evaluation of European breeds of guard dogs for their value in protecting sheep on Western range lands against predators, principally coyotes. Project personnel provided guard dogs for field testing and instructions on their use to cooperating farmers.

An estimated $35,000 worth of sheep were saved during the first year that 24 young dogs were evaluated and at least $100,000 in the second year. The cost for these dogs over a 2-year period would be about $28,000 which means a return of 480 percent of a producer's investment in a guarding dog. Laboratory work and other controlled studies were carried out in support of field testing. Problematic behavior was analyzed in order to find out why some dogs do not always work well and whether misbehavior could be corrected either by training or selective breeding.

Guard dogs provide a nonlethal method of protecting sheep against predators and avoid the use of hazardous and sometimes nonselective poisons.

Epididymitis in Lambs

Researchers at the Idaho State Agricultural Experiment Station have been working closely with a number of range sheep producers to control ram epididymitis caused by *Brucella ovis* in their flocks. This disease has been estimated to cost the range producers $1.2 million in reduced lamb production and an additional $75,000 maintenance costs on infertile rams per year.

Methods used and compared were culling based on 1) palpation of testicles, 2) palpation and semen quality, including presence of white cells, and 3) vaccination plus culling based on palpation and semen quality, and culling based on palpation and semen quality plus serology results. Serology included the complement fixation and enzyme-linked immunosorbent assay (ELISA) tests.

All measures described above reduced the initial incidence of clinical epididymitis, but with palpation alone the incidence stabilized at 20 percent due to undetected carriers in the flock. Palpation plus semen evaluation dropped incidence to approximately 10 percent. Semen evaluation identifies up to 95 percent of the carriers. However, enough carriers are missed to propagate the disease. Vaccination, in addition, drops incidence to 5 percent. The best control method is the use of serology testing, but there can be occasional false negatives. Therefore, eradication of the disease may still require several years of surveillance.

Even though the disease may still be present in a flock, control measures and reduction of incidence can increase lamb crops by 10 to 20 percent.

Horses

Pathogenesis of Navicular Disease in the Equine

Research into the pathophysiology of navicular disease at the Florida State Agricultural Experiment Station, College of Veterinary Medicine, has revealed that the disease involves more than the navicular bone alone. Radiographic signs can now be more closely correlated to specific pathologic processes. Further research is hoped to elucidate the pathophysiology of the changes, however, preliminary work indicates that invasion of the navicular bone by joint lining cells contributes to both the appearance of the "vascular channels" on the radiograph as well as "bone cysts." The research also indicates that the invasion is activated by inflammation in either the coffin joint or navicular bursae. In addition, degenerative changes in the tendons and tendon stress also lead to specific changes that are seen on the radiograph. This study, when completed, will help to develop treatment possibilities as well as aid the practitioner in this knowledge of how the disease might be expected to progress in specific patients.

A Method to Evaluate the Nutritional Status of Iron in Horses

Occasionally, horses are given large amounts of iron to improve performance. Although iron deficiency could limit erythrocyte production and other functions related to nonhematological tissues, it probably only occurs in blood loss. Scientists in the Kansas State University, College of Veterinary Medicine, have developed an enzyme immunoassay for ferritin in equine sera and evaluated its relationship to iron stored in liver and spleen. Serum ferritin correlated significantly with the concentration of nonheme iron in the liver and spleen. It increased following iron therapy and decreased after intentional bleeding of the horses. These scientists conclude that serum ferritin provides a good index of hepatic and splenic iron and can be used to evaluate iron storage in horses.

Leptospirosis and Equine Recurrent Uveitis (Periodic Ophthalmia--Moon Blindness).

Research by Florida scientists has confirmed the important role of leptospirosis in the etiology of equine recurrent uveitis. In a survey of

horses with the disease in Florida and horses from a slaughterhouse in North Carolina, antibodies to Leptospira interrogans serovar pomona were found in the eyes of 20 to 50 percent of the cases. This is definitive evidence of the involvement of this organism in the disease, whereas the mere finding of agglutinins in the serum is not correlated with the disease.

These scientists also investigated an outbreak of uveitis in a saddle-bred brood mare farm in Nebraska, and in this instance evidence of involvement of L. grippotyphosa was found. Again, there was evidence of intraocular synthesis antibody thus definitively implicating the organism. These findings raise the possibility that vaccination with multiple serovars of Leptospira interrogans may be of value in the prevention of this serious and potentially blinding eye disease.

Aquaculture

New Test Detects Carriers of Channel Catfish Virus

Research at Mississippi State University has applied the techniques of molecular biology to the detection of adult carriers of channel catfish virus. The virus is the only known viral pathogen in catfish and can result in 90 to 100 percent mortality among young fish. With the rapid expansion of the catfish industry, the virus has become a major factor in economic losses. The new detection method uses a portion of the viral DNA cloned by recombinant DNA methods to probe for the presence of viral DNA in the adult catfish. The detection method promises a relatively rapid, nondestructive process to examine brood stock fish for the virus.

Environmental Gill Disease in Rainbow Trout

The results of studies conducted this year by University of Idaho scientists clearly indicate that Environmental Gill Disease (EGD) in salmonids has a very complex etiology. It appeared in previous studies that concentrated environmental ammonia was the primary causal factor. It is now found that population density-generated stress is the prime causal factor with ammonia and solids acting as exacerbating factors. Gill disease is a primary limiting factor in the aquaculture production of rainbow trout in Idaho where over 90 percent of the U.S. supply of this commodity originates. With the cause of this disease understood, it now will be possible to develop practical methods of control.